

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A phased array antenna comprising:
a plurality of radiating elements;
a feed line assembly;
a ground plane positioned between the plurality of radiating elements and the feed line assembly;
a phase shifter coupled to the feed line assembly, the phase shifter comprising a tunable dielectric film having a dielectric constant tunable at approximately 300 degrees K;
the ground plane having a plurality of pairs of orthogonal openings, each pair of orthogonal openings positioned adjacent to one of the radiating elements; and
the feed line assembly including a plurality of microstrip lines, each of the microstrip lines including a first portion positioned adjacent to one of the pairs of orthogonal openings.
2. (Original) A phased array antennas as recited in claim 1, wherein:
the openings are elongated.
3. (Original) A phased array antenna as recited in claim 1, further comprising:
a linear microstrip line connected to the plurality of microstrip lines, wherein each of the plurality of microstrip lines extends perpendicularly from the linear microstrip line.
4. (Original) A phased array antenna as recited in claim 3, wherein the plurality of radiating elements are arranged in a plurality of rows and columns, and wherein the feed line assembly further comprises:
additional linear microstrip lines and additional pluralities of microstrip lines extending perpendicularly from the additional linear microstrip lines.

5. (Original) A phased array antenna as recited in claim 1, wherein:
the first portion of each of the plurality of microstrip lines includes a 90° bend, and the bend is positioned between sections of the first portion that are positioned adjacent to the orthogonal openings in one of the pairs of orthogonal openings.
6. (Original) A phased array antenna as recited in claim 1, wherein:
the first portion of each of the plurality of microstrip lines has a predetermine length for providing a 90° phase shift between the openings of an adjacent one for pairs of orthogonal openings.
7. (Currently Amended) A phased array antenna as recited in claim 1, wherein the phase shifter comprises:
a first substrate;
thea tunable dielectric film positioned on a surface of the first substrate;
a coplanar waveguide positioned on a surface of the tunable dielectric film opposite the first substrate;
an input for coupling a radio frequency signal to the coplanar waveguide;
an output for receiving the radio frequency signal from the coplanar waveguide; and
a connection for applying a control voltage to the tunable dielectric film.
8. (Original) A phased array antenna as recited in claim 7, further comprising:
a first impedance matching section of the coplanar waveguide coupled to the input; and
a second impedance matching section of the coplanar waveguide coupled to the output.
9. (Original) A phased array antenna as recited in claim 8, further wherein the first

impedance matching section comprises a first tapered coplanar waveguide section; and
wherein the second impedance matching section comprises a second tapered coplanar waveguide section.

10. (Original) A phased array antenna as recited in claim 7, wherein the connection for applying a control voltage to the turntable dielectric film comprises:

a first electrode position adjacent a first side of a conductive strip of the coplanar waveguide to form a first gap between the first electrode and the conductive strip; and
a second electrode position adjacent a second side of the conductive strip to form a second gap between the second electrode and the conductive strip.

11. (Original) A phased array antenna as recited in claim 10, further comprising:

a third electrode position adjacent a first side of the first electrode opposite the conductive strip to form a third gap between the first electrode and the third electrode; and
a fourth electrode position adjacent a first side of the second electrode opposite the conductive strip to form a fourth gap between the second electrode and the fourth electrode.

12. (Original) A phased array antenna as recited in claim 10, further comprising:

a conductive dome electrically connected between the first and second electrodes.

13. (Original) A phased array antenna as recited in claim 7, wherein the substrate comprises MgO, LaAlO₃, Al₂O₃, and a ceramic.

14. (Original) A phased array antenna as recited in claim 7, wherein the substrate has a dielectric constant of less than 25.

15. (Original) A phased array antennas as recited in claim 7, wherein the tunable dielectric film has a dielectric constant of greater than 300.

16. (Original) A phased array antenna as recited in claim 7, wherein the phase shifter further comprises:

- a second substrate positioned adjacent to an end of the first substrate;
- a microstrip line positioned on a surface of the second substrate; and
- a connection between the microstrip line and a conductive strip of the waveguide.

17. (Original) A phased array antenna as recited in claim 7, wherein the tunable dielectric film comprises one of the group of:

- barium strontium titanate ($\text{Ba}_x\text{Sr}_{1-x}\text{TiO}_3$, BSTO, where x is less than 1) BSTO-MgO, BSTO-MgAl₂O₄, BSTO-CaTiO₃, BSTO-MgTiO₃, BSTO-MgSrZrTiO₆, and combinations thereof.

18. (Original) A phased array antenna as recited in claim 7, wherein the tunable dielectric film comprises a barium strontium titanate composite.

19. (Original) A phased array antenna as recited in claim 7, wherein the tunable dielectric film has a dielectric constant between 70 and 600, a tuning range of 20 to 60 %, and a loss tangent between 0.008 and 0.03 at K and Ka bands.

20. (Original) A phased array antenna as recited in claim 1, further comprising:
a conductive housing enclosed the phase shifter.